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ABSTRACT

This study investigated two approaches for obtaining job ratings in order to determine which procedure provided the most stable ratings, given a constant number of raters. Specifically, it compared reliability estimates determined by averaging across individually obtained job ratings and reliability estimates based on consensus ratings from interacting panels. To investigate reliability of job ratings obtained from individuals and from panels of raters, 450 basic airmen rated 100 brief job descriptions individually and in panels of three and five raters. Analysis revealed that estimates of mean reliability were greater for individual raters, and mean rating time increased with panel size. Consequently, the individual approach appears to be more economical and efficient than the panel procedure, in terms of reliability, time required, and number of raters required. (Author/BH)

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RELIABILITY OF INDIVIDUAL VERSUS GROUP JOB PAY RATINGS

By

Ralph S. Hoggatt, LtCol, USAF
Joe T. Hazel, LtCol, USAF

PERSONNEL RESEARCH DIVISION
Lackland Air Force Base, Texas

May 1970

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FOREWORD

This research was completed under Project 7734, Development of Methods for Describing, Evaluating, and Structuring Air Force Occupations; Task 773402, Development and Appraisal of Methods for Job Evaluation.

The present study compares the reliability of job ratings made by individuals to job ratings made by panels of judges. Results provide information useful to the evaluation of Air Force jobs. Certain findings may also be applicable to other situations where boards or panels are used to reach personnel decisions.

Appreciation is expressed to MSgt R. E. Sprouse, Mr. C. L. Cannon, and Mr. T. G. Whitney who conducted the experimental sessions, and to Mr. R. S. Massar for developing the computer programs for the statistical analyses. Dr. R. E. Christal provided assistance in interpretation of results, and SMSgt D. K. Cowan handled the administrative and statistical details.

This report has been reviewed and is approved.

John G. Dailey, Colonel, USAF
Commander

ABSTRACT

This study investigated two approaches for obtaining job ratings in order to determine which procedure provided the most stable ratings, given a constant number of raters. Specifically, it compared reliability estimates determined by averaging across individually obtained job ratings and reliability estimates based on consensus ratings from interacting panels. To investigate reliability of job ratings obtained from individuals and from groups or panels of raters, 450 basic airman rated 100 brief job descriptions under three conditions; (*a*) individually, (*b*) in a 3-man panel, and (*c*) in a 5-man panel. Analyses revealed that estimates of mean reliability were larger for individually obtained ratings than for 3-man or 5-man panel ratings. There was also a trend for mean rating time to increase with an increase in panel size. Present findings tend to support the procedure of averaging across individual ratings, rather than the use of ratings from panels, in order to obtain more stable results. In terms of reliability, time required, and number of raters, the individual approach appears more economical and efficient than the board or panel procedure.

SUMMARY

Hoggatt, R.S. & Hazel, J.T. *Reliability of individual versus group job pay ratings.* AFHRL-TR-70-10 Lackland AFB, Tex.: Personnel Research Division, Air Force Human Resources Laboratory, April 1970.

Problem

The Air Force often uses boards to reach personnel decisions such as those made in promotion selection, school nomination, and job evaluation. In some board situations, averages of ratings obtained individually are used as a basis for decisions concerning persons or jobs. In contrast, consensus ratings of boards may be used to reach decisions. For either approach, stable ratings reflecting high agreement among judges are desirable.

In terms of job evaluation, this study investigated two procedures to determine which provides the most stable ratings, given a constant number of raters. Specifically, reliability estimates based on ratings obtained individually were compared to reliability estimates based on consensus ratings obtained from interacting 3-man and 5-man panels. In addition to reliability, the economy and efficiency of the two methods were considered.

Approach

To examine individual *versus* panel differences in reliability of job pay ratings, three experimental conditions were selected to produce (*a*) individual ratings, (*b*) ratings of 3-man panels, and (*c*) ratings of 5-man panels. The task for subjects in each condition was to provide pay ratings of brief job descriptions using a 9-point scale. The job sample included 100 brief descriptions distributed over high to low socioeconomic levels, but each individual or panel was required to rate only 20 jobs. The subjects were 450 basic airmen, with 150 subjects randomly assigned to each of the three conditions. The number of raters in each condition was held constant, although the number of ratings per job varied as a consequence of the division of subjects into 3-man and 5-man groups.

Results

Intraclass correlation analyses were used to compare the reliability of job ratings for the individual, 3-man panel, and 5-man panel conditions. Results of these analyses revealed that estimates of mean reliability were larger for the individual condition than for the two panel situations, when estimates accounted for number of ratings per job. This finding was consistent when projected across various size samples. Multiple range tests revealed a statistically significant difference between the mean time required for the individual and the 5-man panel situations, and there was a trend for the time required to increase with an increase in panel size. Other analyses between individual and panel pay ratings found the distributions of the mean pay ratings for the 100 jobs were similar, and there were no significant differences among rating means for the three conditions.

Conclusions

When both reliability and time required to make ratings are considered, an individual rating situation appears preferable to a group rating situation. The evidence supports the procedure of averaging individual ratings, rather than dividing raters into panels and obtaining consensus group ratings, in order to obtain more stable mean job ratings. In terms of reliability and economy of time, averaging ratings across individuals appears more efficient. More time and more raters may be required for the panel situation to achieve reliability estimates comparable to those achieved by the individual situation. Further, the number of man-hours required by 5-man panels suggests that the use of larger sized panels may be prohibitive from a practical standpoint.

This summary was prepared by J. T. Hazel, Personnel Systems Branch, Personnel Research Division, Air Force Human Resources Laboratory.

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RELIABILITY OF INDIVIDUAL VERSUS GROUP JOB PAY RATINGS

I. INTRODUCTION

The Air Force often uses boards or panels to reach personnel decisions such as those made in promotion selections, school nominations, and job evaluations. In some board situations, averages of ratings obtained individually are used as a basis for decisions concerning persons or jobs. In contrast, consensus ratings of boards may be used to make decisions. For either approach, stable ratings reflecting high agreement among judges are desirable, in order to place greater reliance on the validity of decisions.

A cursory review of the literature concerning small group behavior over the past fifty years suggests certain controversy persists concerning the comparative effectiveness of group performance and individual performance. Part of this controversy may be due to insufficient distinction between reliability and validity in defining superior performance. In terms of job evaluation reliability, this study made certain comparisons between individual and group rating procedures.

In the evaluation of Air Force jobs, a systematic procedure is followed whereby the judgments of experienced officers are used to determine equitable pay grades for various jobs. A series of studies has been undertaken to investigate variables and job requirement factors involved in this procedure. Some of the variables which have been investigated are number of raters per job, length of job descriptions, time spent on evaluation, and different categories of raters (Christal, Madden, & Harding, 1960; Hazel, 1966; Hazel & Cowan, 1966).

The present study compared the stability of job pay ratings obtained individually from judges with ratings obtained from different sized panels of judges. The panel ratings represented the consensus of interacting groups. Two panel rating situations were compared with an individual situation in order to determine which approach yielded the most stable ratings, and was most efficient with regard to time required and number of raters. More specifically, the question was examined whether, given a constant number of raters, more reliability can be obtained by averaging across individual ratings or by obtaining consensus ratings from 3-man and 5-man panels.

II. METHOD

To examine reliability differences between individual and group job pay ratings, three experimental conditions were selected. The task for subjects in each of these conditions was to provide pay ratings of brief job descriptions, either individually or as panel members. A total of 100 job descriptions was used, but each individual or panel was required to rate only 20 jobs. The essential features of the three conditions, instructions, subjects, job descriptions, and rating scale are described subsequently.

Experimental Conditions

In one condition, individual ratings were obtained on 100 job descriptions. In two conditions, panel ratings were obtained for the same job descriptions. The tasks and compositions of the three conditions were as follows:

1. *Individual ratings.* For this condition, each subject individually rated a set of 20 job descriptions. There were five sets of descriptions, or a total of 100 jobs. Each job received 30 ratings, so the total ratings for this condition was 3,000 (i.e., 100 jobs times 30 ratings).

2. *3-man panel ratings.* For this condition, each subject was randomly assigned to a 3-man panel. Each panel reached a consensus, then rated a set of 20 job descriptions. As before, there were 100 jobs (5 sets), but each job received only ten 3-man panel ratings. This required 50 panels and yielded a total of 1,000 ratings (i.e., 10 panel ratings per job times 100 jobs).

3. *5-man panel ratings.* For this condition, each subject was randomly assigned to a 5-man panel. Each panel reached a consensus, then rated a set of 20 job descriptions. As before, there were 100 jobs (5 sets), but each job received only six 5-man panel ratings. Thirty panels were required, and this yielded a total of 600 ratings (i.e., 6 ratings per job times 100 jobs).

Subjects

The subjects used to obtain pay ratings on the 100 job descriptions were 450 basic airmen assigned to Lackland Air Force Base, Texas. Although the number of ratings per job differed for the three conditions (i.e., 30 individual ratings, 10 ratings from 3-man panels, and 6 ratings from 5-man panels), the number of raters per job was held constant (i.e., 30). Consequently, 150 subjects were randomly assigned to each of the three conditions.

Procedure

Within prescribed limits, the procedures and instructions were similar for the three conditions. Essentially, each subject in condition 1 or each panel in conditions 2 and 3 was provided a set of 20 job descriptions and asked to rate these jobs on a 9-point scale. All individuals (condition 1) and all panels (conditions 2 and 3) made their ratings simultaneously; however, the three groups were separated. The time in minutes was recorded for individual and panel ratings. Detailed instructions for the three conditions are given in Appendix I.

Job Descriptions

Four requirements were considered in the selection of the 100 job description sample:

1. Suitability of job descriptions for use with the rater groups (i.e., basic airmen).

2. Availability of selected job descriptions in a standard reference source.

3. Reduction of context effects by inclusion of high-, moderate-, and low-pay jobs in the job sample.

4. Identification of some basis for an empirical determination of the pay spread among jobs. This requirement appeared necessary to insure adequate variation among jobs, and provided a realistic framework for determination of a monthly pay rating scale.

The first requirement, suitability, was recognized by selecting commonly encountered or familiar jobs. Unique titles or highly specialized jobs (e.g., agronomist, flumer, zanjero) were avoided. Relevancy of certain job descriptions to Air Force jobs was also considered (e.g., airplane mechanic, pilot). Availability of job descriptions in a standard source was resolved by selection of jobs listed in the *Dictionary of Occupational Titles*, Volume I (1965).

A study by Madden (1960) demonstrated that inclusion of only high-value (or only low-value) jobs together introduced serious bias in job evaluation scores. To help reduce such context effects and also to form some basis for an empirical pay spread among jobs, the occupations and social status report by Reiss (1961) was used extensively.

The problem outlined by Reiss was the investigation of the prestige or social status of various occupations, considering such variables as education and income levels. Socioeconomic indexes were obtained on 425 jobs outlined in the occupational classification of the 1950 United States Census of Population. These indexes were constructed on a population of males in the 1950 experienced labor force. The 425 jobs were grouped into 12 major occupational categories (Reiss, 1961, pp. 154-155). Titles of these major occupational groups are given in Appendix II.

To counterbalance context effects, job samples from various major occupational groups at different socioeconomic index levels were selected (Reiss, 1961, Table B-1, pp. 264-275). The distribution of the 100 job samples for 12 occupational groups at 10 socioeconomic index levels is given in Table 1. The median number of jobs selected from the socioeconomic index levels was approximately 10, with the range from 19 to 5. Jobs for two groups, private household and unreported occupations, were omitted.

The basis used to determine an empirical pay spread among jobs was the 1966 median earnings of male civilians in the same 10 occupational groups previously described. This information was obtained from the Bureau of the Census publication *Statistical Abstract of the United States* (1968). The annual and monthly incomes of the 10 occupational groups are given in Appendix II. As shown, there was considerable variation in monthly pay of the occupational groups. This variation, ranging from $767 to $215 was assumed adequate to reduce spurious reliability values.

After determining the number of jobs desired in the various socioeconomic level and occupational group categories, the actual selection of a representative sample of 100 brief job descriptions was undertaken. This action consisted of reviewing job descriptions in the *Dictionary of Occupational Titles* (DOT), and evaluating jobs in terms of the four requirements, suitability, availability, context effect, and empirical pay spread. After 100 jobs were selected, abstracts of the DOT descriptions

Table 1. **Distribution of 100 Job Description Sample by Socioeconomic Index and Occupational Group**

Occupational Group[a]	Socioeconomic Index										
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	Total
1. Professional & Technical					4	1	3	7	9	7	31
2. Farmers & Farm Managers						1					1
3. Managers, Officials & Proprietors				1	1	2	2	2	2		10
4. Clerical			2		7	2	2				13
5. Sales				1							1
6. Craftsmen & Foremen		4	4	3	6	1	2				20
7. Operatives	1	2	3	4	1	1					12
8. Private Household											0
9. Service (except household)	2	5		2							9
10. Farm Laborers & Foremen	1										1
11. Laborers (except farm/mine)	1	1									2
12. Occupations not reported											0
Total	5	12	9	11	19	8	9	9	11	7	100

[a]After Reiss (1961).

were written and edited. The objective for these abstracts was brevity, avoidance of technical terms, and focus on the most prominent duties of a job. The 100 jobs were randomly sorted into one of five sets of 20 job descriptions. The lists of jobs as they were grouped on the five sets of rating forms are given in Appendix III.

Rating Scale

A 9-point monthly pay rating scale was derived from the previously described empirical pay spread among occupational groups. As shown in Appendix II, the upper and lower rounded monthly pay limits were about $800 and $200, with an average of approximately $525. Consequently, the interval 500 - 599 was chosen as the center of the scale (rating 5), with 100-dollar steps above and below this value. To reduce the possibility of truncated ratings and allow for inflationary trends, the scale was extended one point on both extremes to include ratings of 9 and 1. The final scale, considered appropriate and realistic for rating of the 100 job samples, was as follows:

Rating	Monthly Pay Scale
9	$900 or more
8	$800 to $899
7	$700 to $799
6	$600 to $699
5	$500 to $599
4	$400 to $499
3	$300 to $399
2	$200 to $299
1	$100 to $199

III. RESULTS

The analyses of interest for the three conditions were concerned with differences in reliability of ratings, distributions of jobs, means of the job ratings, and mean rating time. Results are reported according to this sequence of analyses.

Reliability

Comparisons of the reliability of job pay ratings for the three conditions were of principle concern. For this purpose, intraclass reliability coefficient procedures[1] described by Haggard (1958) and by Lindquist (1953) were used. Results of these analyses for each condition are given in Table 2. To interpret these coefficients, an explanation of the logic and derivation of values is provided.

Although the number of raters in each condition was held constant ($N = 150$), the number of ratings per job (k) obtained was different for the three conditions (individual k = 30; 3-man panel, k = 10; 5-man panel, k = 6). This design was followed so that reliability could be expressed in terms of a given number of raters per job, as well as a function of number of ratings per job. However, in the determination of reliabilities for the three conditions, the different number of ratings per job was considered. This was accomplished by using the Spearman-Brown procedure described by Lindquist (1953, p. 361) and extended by Christal *et al.* (1960, p.5) to estimate reliability in a job evaluation situation. Such an approach permitted a joint comparison of reliability and assessment of economy in terms of time and number of raters required.

Following this rationale, the most meaningful comparisons appeared to be among reliability estimates of job pay ratings which accounted for the different number of ratings per job, yet involved the same number of raters in each condition. This involved the computation of reliability coefficients (R_M) which were estimates of the *means* of k ratings per job for various size rater samples. To determine these values, "single-rater" coefficients (R_{11}) which reflect interrater consistency were first obtained, then inserted into the Spearman-Brown formula to estimate the reliability of mean ratings for various sample sizes (i.e., when number of raters was held constant but number of ratings per job differed for each condition). The R_{11} and n values used to determine number of ratings per job inserted into the formula for determination of R_M for various size samples are included in Table 2.

[1] With regard to notation, Haggard (p. 11) uses R and Lindquist (p. 361) uses r_{11} to denote intraclass correlation coefficients. The notation used here, R_{11}, was adopted in order to maintain a distinction between intraclass correlation and symbols used to denote multiple correlation (R) and product-moment correlation (r). The R_{11} coefficients are basic computed values inserted into the Spearman-Brown prophecy formula to estimate the mean reliability of job ratings when the number of ratings per job (k) is increased or decreased. The formula used to estimate mean reliability coefficients (R_M) for various sample sizes was

$$R_M = \frac{(n)(R_{11})}{1 + (n-1)(R_{11})}$$

where

n = amount of increase or decrease in k for various sample sizes

Table 2. **Reliability Estimates (R_M) for Various Sample Sizes in Three Rating Conditions**

Rating Condition	R_M[a] by Sample Size			
	75 *Ss* 15 per job[b]	150 *Ss* 30 per job[b]	225 *Ss* 45 per job[b]	300 *Ss* 60 per job[b]
1. Individual	.9370	.9675	.9781	.9835
2. 3-man panel	.9170	.9567	.9707	.9779
3. 5-man panel	.8669	.9287	.9513	.9630

[a] Basic R_{11} coefficents inserted into Spearman-Brown formula to determine R_M: Individual, .4978; 3-man, .6884; 5-man, .6846.

[b] n values (ratios) used to determine number of ratings per job in Spearman-Brown formula:
Individual, n = 1.0 (e.g., 15 ratings from 15 raters)
3-man panel, n = 1/3 (e.g., 5 ratings from 15 raters)
5-man panel, n = 1/5 (e.g., 3 ratings from 15 raters)

As shown and compared in Table 2, given a constant number of raters and accounting for number of ratings per job, the mean reliability coefficients (R_M) were larger for the individual condition than for the two panel conditions. For example, these results indicated that 75 subjects divided into 3-man or 5-man panels did not give as reliable mean estimates as 75 individual raters. Further, the larger reliability estimates obtained by averaging across individual raters held for all the various size samples. In regard to the magnitude of the reliability estimates, the obtained values (R_M) compared closely to results obtained in other job evaluation studies (Christal *et al.*, 1960; Hazel & Cowan, 1966). Generally, from 10 to 15 ratings per job yield very stable mean estimates.

Distribution of Jobs

To determine whether the distributions of mean ratings of the 100 jobs for the three conditions were significantly different, a chi-square test was computed. This test was based on the frequency distributions of the 100 job means (rounded) for each condition, as shown in Table 3. Because the frequencies of the extreme scale levels (ratings 9 and 1) were zero or small, the two upper categories, 8 and 9, and the two lower categories, 1 and 2, were combined. The results of this analysis shown in Table 3 revealed there were no significant differences in distributions for the three conditions ($p > .05$).

Mean Job Ratings

The means of the job ratings for the three conditions, including number of cases on which these means were based, are given in Table 4. An analysis of variance was performed to determine if there were significant differences among the three means. As shown in Table 4, the results of this analysis revealed no significant differences among means ($p > .05$).

Time Required for Ratings

To test for differences in the mean time required to complete ratings of jobs in the three conditions, a multiple range test was used (Edwards, 1960, p. 136). This analysis was based on the time in minutes for each individual (condition 1) or panel (conditions 2 and 3) to rate 20 jobs. Included were 150 sets of 20 job observations for condition 1, 50 sets of observations for condition 2, and 30 sets of observations for condition 3. Results of the analysis are given in Table 5, which includes mean differences. As shown, there was no significant time difference ($p > .01$) between conditions 1 and 2, or between 2 and 3. However, the individual time was significantly smaller ($p = .01$) than the 5-man panel time. There was also a definite trend for mean time to increase as panel size increased.

Table 3. **Distributions of Mean Pay Ratings in Three Rating Conditions**

Rating Level (Mean)	Distribution at Rating Level by Condition		
	Individual	3-man panel	5-man panel
9	0	0	0
8	4	7	12
7	8	8	5
6	16	12	13
5	22	22	22
4	30	27	22
3	14	11	18
2	5	12	7
1	1	1	1

$\chi^2 = 11.59$; $df = 12$; $p > .05$

Table 4. **Mean Pay Ratings for Three Conditions**

Rating Condition	N	Mean Rating
1. Individual	3,000	5.18
2. 3-man panel	1,000	5.03
3. 5-man panel	600	5.18

$F = 1.55$; $df = 2/4597$; $p > .05$

Table 5. **Mean Rating Times and Differences Between Means for Three Rating Conditions**

Rating Condition	Difference Between Means for Rating Conditions		
	Individual	3-man panel	5-man panel
1. Individual	--	2.23	6.76
2. 3-man panel	2.23	--	4.53
3. 5-man panel	6.76	4.53	--

Mean Rating Time for Condition[a]		
(1)	(2)	(3)
4.34	6.57	11.10

[a]Means not underscored by the same line are significantly different ($p = .01$).

Since time required for ratings and number of raters involved are practical matters which must also be considered in determining whether an individual approach or a panel approach is preferable, the simultaneous presentation of certain reliability and time requirement results appeared desirable. As shown previously, the reliability estimates for the individual ratings were larger than for the panel ratings, and there was a trend for mean time to increase with panel size. Such a joint presentation would help deomonstrate more clearly whether averaging across individual ratings or obtaining a consensus from panels yielded more stable job ratings, and would also permit evaluation of the efficiency of the two approaches with regard to these practical matters.

The mean reliability estimates (R_M) and total number of man-hours (approximate) required to accomplish ratings of the 100 jobs by 150 subjects in each of the three conditions are given in Table 6. Data sources and method of ascertaining man-hours for these values are included.

As reflected in Table 6, the individual condition provided more stable estimates and was much more efficient in terms of a time requirement than the panel conditions. Since the 5-man panel yielded the lowest rating reliability, yet required 2-1/2 more man-hours than the individual situation, the use of panels of this size appears rather inefficient.

Table 6. **Reliability Estimates and Man-Hours Required for Three Rating Conditions**

Rating Condition	Reliability Estimate[a]	Man-hours Required[b]
1. Individual	.97	10.85
2. 3-man panel	.96	16.43
3. 5-man panel	.93	27.75

[a] R_M values (rounded) from Table 2 for 150 *Ss*.

[b] Computed by multiplying mean time for rating condition in Table 5 by number of rater (150 *Ss*) and dividing by 60 (minutes).

IV. DISCUSSION AND CONCLUSIONS

This study investigated the problem of how to obtain more stable mean job ratings, given a constant number of raters. Specifically, it compared reliability estimates of job ratings determined by averaging across ratings obtained individually with reliability estimates of ratings of 3-man and 5-man interacting panels.

Intraclass correlation analyses comparing job pay ratings revealed that estimates of mean reliability were larger for the individual condition than for the 3-man or 5-man panels, when estimates accounted for differing numbers of ratings per job. This finding was consistent when projected across samples of various sizes. Other results did not indicate any statistically significant differences between individual and group job pay ratings except for the time required for ratings in an individual *versus* a 5-man panel situation. The distributions of the mean pay ratings for the 100 jobs were similar ($p > .05$), and there were no significant differences ($p > .05$) among rating means for the individual, 3-man panel, and 5-man panel conditions.

When both reliability and time required to collect ratings were considered, the evidence indicated that the individual rating situation is preferable and more economical than the use of panels. There was a trend for rating time to increase as a function of panel size. However, there was not a concurrent increase in reliability with an increase in time required for rating. This finding tends to agree with a previous study (Hazel, 1966) which found reliability did not increase significantly as a function of rating when job evaluations were made individually.

The present findings tend to support the procedure of averaging across individual ratings rather than dividing raters into panels and obtaining consensus group ratings. The mean reliability estimates for interacting 3-man or 5-man panels were not superior to the mean reliability estimates for individual raters. In terms of reliability, economy of time, and number of raters, the averaging of individual ratings appears more efficient. More raters and time may be required for the panel situation than for the individual situation to

achieve comparable estimates of reliability. In addition, the number of man-hours required to obtain ratings from 5-man panels was of sufficient magnitude to suggest that larger sized panels may be inefficient from a practical standpoint.

Certain caution appears warranted, however, in generalizing results from the present rater groups with simple job descriptions to typical Air Force boards or panels. Usually experienced senior officers comprise Air Force boards, and more complex and detailed job descriptions are used for operational job evaluations. Replication of this study using senior officer raters appears desirable. However, a study related to the question of generalization of results (Hazel & Cowan, 1966) found agreement among four rater groups with regard to reliability and homogeneity of job ratings.

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APPENDIX I. ADMINISTRATIVE PROCEDURES AND INSTRUCTIONS FOR EXPERIMENTAL CONDITIONS

To obtain the desired pay ratings on 100 jobs from 450 basic airmen under three conditions, the following procedures and instructions were established.

Experimental Conditions

1. *Individual ratings.* The 150 subjects were required to rate job descriptions using a 9-point scale. Thirty ratings per job for five sets of 20 descriptions (i.e., 100 jobs) were required.

2. *3-man panel ratings.* The 150 subjects were randomly divided into fifty 3-man panels on entry into the testing room. Each panel rated 20 job descriptions using a 9-point scale. Ten ratings per job for the 100 descriptions were required.

3. *5-man panel ratings.* The 150 subjects were randomly divided into thirty 5-man panels. Each panel rated 20 job descriptions using a 9-point scale. Six ratings per job for the 100 descriptions were required.

Materials

The materials provided all subjects consisted of a Test Record Card and list of 20 job descriptions (for individual or panel use). The 100 job descriptions were divided into five sets of 20 descriptions, and these sets were the same for all three conditions. Each set contained instructions, coding information, and a 9-point monthly pay scale.

The Test Record Card was used to obtain certain subject identification and other personal data. All materials distributed to all raters had a 6-digit prenumber code affixed to identify the experimental condition, job set number, panel number, and subject test number.

Administrative Procedures

On the day of testing, 150 basic airmen were randomly selected for each of the three experimental conditions. The 3-man and 5-man panels were treated similarly, except for number of panel members. Essential procedures and instructions applied to each condition were as follows.

Condition 1. Individual. For this condition, all subjects were tested simultaneously. On entry into the testing room, each subject was provided with a Test Record Card, written instructions, and a job description list. Instructions were also read aloud to subjects.

INDIVIDUAL INSTRUCTIONS

The Air Force is interested in your opinions concerning various jobs. Individually, each of you will rate several rather familiar jobs on a 9-point pay scale to show what you consider as the proper monthly pay for each job. In brief, you will indicate the amount of pay per month which you believe that workers in 20 jobs should receive.

1. First, you will complete the Test Record Card. Do this now. Note the testing number in the upper right corner of this card matches the testing number on the Job Description List.

When you have finished the Test Record Card, wait until the examiner tells you before you begin your ratings.

2. Second, write your name at the top of the Job Description List. You are to rate all 20 jobs using a number from 1 to 9 which is indicated on the rating scale at the top of your Job Description List. For instance, if you believe a job on your list should be paid from $500 to

$599 per month, write in a 5 in the left-hand space opposite that job. Consider monthly pay based on a normal work week for each job. The jobs you rate may be professional, salaried, wage, or self-employed, and may be paid weekly, bi-weekly, monthly or on an hourly or piece-rate basis. We are interested in your best estimate of monthly pay so there are no right or wrong ratings in this task. Hold your hand up if you have any questions.

3. You are now ready to begin your ratings of the 20 jobs. At the top of the Job Description List enter the time you start your ratings.

4. After completion, write in the time you completed your ratings. Put the total amount of time in minutes you took to make your ratings in the appropriate box. This is not a timed activity and you will be given all of the time you need. We want to know how long it takes you to make the ratings.

5. The Examiner will excuse you from the testing room when you have completed your task. Leave all of your material on your desk.

READY: Commence your ratings.

Conditions 2 and 3. 3-man panel and 5-man panel. On entry into testing room, the 150 subjects for each of these two conditions were randomly divided into fifty 3-man panels or into thirty 5-man panels, as appropriate. Large testing rooms were prepared in advance so there was wide spacing between panels. When the groups were assembled, the following material was distributed to each panel: set of instructions (for 3-man panel or 5-man panel); Test Record Card for each subject; one "Panel Report" job description list (on a random basis to each panel); and lists of job descriptions for use by each panel member.

The instructions, as appropriate and separately for the two panel conditions, were read aloud to all panel members.

PANEL INSTRUCTIONS

The Air Force is interested in your opinions concerning various jobs. You will be asked to rate several rather familiar jobs on a 9-point pay scale to show the proper monthly pay for each job. In brief, you will indicate the amount of pay per month which you believe that workers in 20 jobs should receive. You will do this as a 3-man (or 5-man) group or panel.

1. First, look at the package of material that has been given your 3-man (or 5-man) panel. Lay the "Panel Report" sheets and Job Description Lists aside and let each panel member take one of the Test Record Cards.

Each panel member will complete a Test Record Card. Do this now. Note the testing number in the upper right corner of this card matches the testing number on your Job Description List.

When you have finished the Test Record Card, wait until the examiner gives you further instructions before you begin your ratings.

2. Second, as a panel you are to determine a single rating for each of the 20 jobs. As a group, you are to rate the 20 jobs using a number from 1 to 9 which is indicated on the rating scale at the top of your Job Description List. For instance, if you believe a job on your list should be paid from $500 to $599 per month, write in a 5 in the left-hand space opposite that job. Consider monthly pay based on a normal work week for each job. The jobs you rate may be professional, salaried, wage, or self-employed, and may be paid weekly, bi-weekly, monthly or on a hourly or piece-rate basis. We are interested in your best estimate of monthly pay so there are no right or wrong ratings in this task.

Each panel can decide its own method of operation. Use the "Panel Report" to record these ratings. Each panel will rate all the jobs using the 1 to 9 scale at the top of the Panel Report and enter their ratings in the left-hand spaces opposite each job.

The panel judgment should be arrived at after discussing and considering all factors applicable to the job. Each panel will work independently and not disturb other groups. As a panel you should all agree unanimously that the value you record is your panel's best judgment of the appropriate monthly pay for the job. Each member of the panel has an opportunity to voice his opinion.

On the "Panel Report" carefully record the starting time, time of completion, and number of minutes needed to make your panel ratings. This is not a timed activity and each group will be given all the time needed. However, we are interested in knowing the correct amount of time it takes you to make the ratings.

3. The examiner will excuse each panel from the testing room when each group has completed its task. Leave all material on your desk when completed.

READY: Commence your ratings.

APPENDIX II. MEDIAN ANNUAL AND MONTHLY INCOME OF MALE CIVILIANS FOR MAJOR OCCUPATIONAL GROUPS

Occupational Group[a]	Annual Income[b]	Monthly Income
1. Professional and technical	$9,205	$767
2. Farmers and farm managers	3,547	296
3. Managers, officials, and proprietors	8,826	736
4. Clerical	6,542	545
5. Sales	7,553	629
6. Craftsmen and foremen	7,161	597
7. Operatives	6,135	511
8. Private household[c]		
9. Service (except private household)	5,117	426
10. Farm laborers and foremen	2,576	215
11. Laborers (except farm and mine)	5,133	428
12. Occupations not reported[c]		

[a]From Reiss (1961), pp. 154-155.

[b]From *Statistical Abstract of the United States (1968)*, Table 335 presenting data for 1966.

[c]Omitted in *Statistical Abstract*.

APPENDIX III. FIVE SETS OF JOB DESCRIPTIONS

Set 1

1. *News Reporter.* Collects pertinent facts by interview or investigation about events having news value. Covers special assignments. Writes stories for newspaper publication.
2. *Purchasing Agent, Retail Store.* Purchases materials and supplies at most favorable price, necessary for operation of store. Approves specifications, draws up contracts, and approves bills for payment. Keeps records of purchases.
3. *Automobile Washer.* Cleans inside with broom, cloth, mop, and vacuum cleaner. Cleans outside with soap, water, sponge, and chamois. May wax and polish the outside.
4. *Pharmacist.* Compounds and dispenses medicines and preparations prescribed by licensed physicians. Performs tests to determine identity, purity, and strength of drugs. Maintains stock of drugs and chemicals.
5. *Airplane Mechanic.* Overhauls, services, and inspects airplanes, except engines, both on the flight line and in the shop. Repairs and replaces such parts as fuselage, control cables, tanks, gears, and lines.
6. *Hospital Orderly.* Assists nursing staff in hospital. Lifts patients in and out of bed, carries meal trays, and cleans rooms.
7. *Criminal Lawyer.* Specializes in law cases dealing with crime such as murder and theft. Defends client on charges made against him, examines and cross-examines witnesses, summarizes case and makes closing remarks to jury.
8. *Athletic Instructor.* Gives individual or group beginning or advanced instruction in calisthenics, gymnastics, and other exercises. Teaches use of various athletic equipment. Organizes, instructs, leads, and referees such games as baseball, football, basketball, etc.
9. *Employment Manager.* Interviews applicants, hires or refers those with satisfactory qualifications to proper department. Adjusts disputes and grievances. Reviews transfers and discharges. Conducts research on wages, hours, and working conditions.
10. *Commercial Airline Pilot.* Operates an airplane for transportation of mail, passengers, freight, or other commercial purposes. Operates airplane on scheduled or chartered flights for an airline.
11. *Shipping Clerk.* Prepares merchandise for shipment or delivery. Prepares bill of lading, sorts articles, and keeps records of articles shipped. May receive incoming goods.
12. *Tailor.* Makes tailored garments such as suits, topcoats, and dress clothes. Designs, measures, sews (hand and machine), and fits articles as required. May supervise other workers performing similar tasks.
13. *Automobile Mechanic.* Repairs passenger automobiles and light trucks. Disassembles and assembles and overhauls engines, transmissions, rear ends, and other assemblies.
14. *Bookkeeper.* Keeps systematic set of records of business transactions of an establishment. Balances books and compiles reports at regular intervals to show receipts, expenditures, accounts payable and receivable, and profit or loss.
15. *Librarian Assistant.* Assists librarian by cataloging books, replacing books on shelf, and issuing and receiving books. Sends out overdue notices when necessary.
16. *Telegraph Operator.* Operates telegraphic equipment for transmitting and receiving signals or messages. Makes adjustments to instruments. Assists in other office duties.
17. *Sales Clerk, Retail.* Receives cash from customers, wraps articles purchased, and makes change. Arranges merchandise on shelves in a neat and orderly manner.
18. *Television Repairman.* Repairs and adjusts television receivers. Follows schematic diagram to locate defects. Installs TV sets and antennas.

19. *Longshoreman.* Loads and unloads ships' cargoes. Moves articles on hand trucks and stacks on wharf or in ship. Attaches slings to heavy objects for lifting.

20. *Nurse, Registered.* Does general nurse work in homes, hospitals, and institutions. Administers drugs, medicines, and ointments. Changes dressings on wounds and bathes patients. Prepares operating room, sterilizes instruments, and gives injections.

Set 2

1. *President, College or University.* Administrative head of a college or university. Concerned with the financial and business affairs and academic life of an educational institution.

2. *Musician, Instrumental.* Plays one or more musical instruments in a symphony orchestra, band, or similar musical organization.

3. *Dental Assistant.* Prepares patients for examinations, treatments, or dental surgery. Assists dentist by handing him necessary implements. May sterilize instruments and assist in making dentures.

4. *Draftsman.* Prepares accurate charts, layouts, and detailed drawings according to specified dimensions. Makes finished designs from sketches. Uses manual skill in manipulation of drafting tools and equipment.

5. *Welder.* Fuses metal parts together by means of acetylene torch or electric welding apparatus. Fabricates metal shapes and repairs metal objects. Cuts metal with torch burner.

6. *Physician, General Practitioner.* Attends to all kinds of medical cases. Examines and diagnoses condition of patient. Prescribes treatment and performs minor operations. Writes prescriptions and administers drugs.

7. *Developer, Photographic.* Treats exposed film with a series of chemical and water baths to bring out image. Prepares chemical solutions according to specific formulas. Dries negatives.

8. *Power Service Operator.* Operates and maintains power-production equipment such as generators, meters, and high-voltage switching and control equipment. Operates pumps, compressors, or blowers.

9. *Bank Cashier.* Acts as executive officer of bank. Approves loans, collects debts due bank, and buys and sells collateral. Manages bank and supervises all subordinate officers.

10. *Electrical Engineer.* An engineer who plans and supervises construction and operation of electric-power systems, communication facilities, and electronic equipment. May also engage in research, inspection, and consultation concerning complex electrical equipment.

11. *Watchman.* Guards an industrial plant, warehouse, or other property against fire, theft, or illegal entry. Makes periodic inspection tours of building and grounds.

12. *Typist.* Typewrites letters and addresses envelopes. Fills in reports and forms. Types copy from rough draft or corrected copy. Makes stencils for reproductions.

13. *Dry Cleaner Operator.* Operates dry cleaning machine to clean garments, drapes, and other articles. Determines proper chemicals to use and filters cleaning chemicals after use.

14. *Teacher, High School.* Teaches pupils in church, private, or public high schools (secondary schools) in one or several subjects. May perform duties as student advisor.

15. *Brickmason.* Lays brick, tile, and similar building blocks to construct various structures. Checks alignment of structures. Performs other duties related to bricklaying.

16. *Firefighter (Fireman).* Rides on truck to scene of fire. Connects and mans hose or uses portable fire extinguisher to put water or chemicals on fire. Enters burning buildings to combat fires. Rescues persons overcome by fire or smoke. Administers artificial respiration.

17. *Office Machine Serviceman.* Inspects, adjusts, repairs, and services office machines. May instruct machine operator in correct operating procedures.

18. *Janitor.* Keeps public parts of building in clean and orderly condition. Mops and polishes floors. Removes litter and waste paper.

19. *Carpenter Foreman.* Supervises a group of carpenters on construction projects. Interprets blueprints, sketches, or verbal orders. Assigns duties and inspects work. Keeps time and production records.

20. *Posting-Machine Operator.* Records numerical details of transaction using various bookkeeping machines. Places forms in machine and performs necessary calculations.

Set 3

1. *Motion Picture Projectionist.* Operates motion picture projection and sound producing equipment. Inspects, repairs, and rewinds film. Cleans, repairs, and inspects equipment.

2. *Electrician.* Lays out, assembles, installs, and tests electrical fixtures and wiring. Plans proposed installation from blueprints. Installs and checks wiring systems and electrical equipment.

3. *Sheet Metal Worker.* Fabricates, assembles, alters, repairs, and installs sheet metal articles and equipment. Cuts, drills, grinds, and files metal according to blueprints.

4. *Machinist.* Constructs and repairs all kinds of metal parts, tools, and machines. Reads blueprints and written specifications, working to close tolerances.

5. *Shoe Repairman.* Resoles, reheels, and repairs shoes. Attaches toe and heel cleats, stretches, shines, and replaces buttons or ornaments.

6. *Dispatcher, Motor Vehicle.* Assigns vehicles and drivers for transport of freight or passengers. Keeps records of time and date of delivery, mileage traveled, and drivers assigned.

7. *Medical Technician.* Performs medical duties in hospital or laboratory. Make tests of urine, blood, and infections. Prepares vaccines, types blood, and gives biological skin tests.

8. *Tool Maker.* Specializes in the construction, repair, and maintenance of machine-shop tools, jigs, fixtures, and instruments. Operates various machine tools and performs other highly skilled work.

9. *Clergyman.* Prepares and delivers sermons. Performs ordinances of church. Officiates at meetings and supervises religious education program. Performs additional church duties such as visiting the sick, and giving personal advice and counsel.

10. *School Superintendent.* Formulates plans and policies for the administration of a city or county school system. Supervises the appointment, training, and promotion of teachers and principals.

11. *Bootblack.* Cleans and polishes leather, suede, canvas, and other types of shoes. Assists patrons with coats and brushes coats and hats.

12. *Cook.* Prepares, seasons, and cooks soups, meats, vegetables, and desserts. Usually specializes in specific food dishes.

13. *Meat Cutter.* Cuts, trims, and bones meat using knives, saws, or other instruments. Chops and grinds meats using hand or powered equipment. Prepares various meat products.

14. *Power Shovel Operator.* Operates Diesel or gasoline powered equipment to excavate or move material. Manipulates levers and pedals to move machine and lift boom or shovel.

15. *Secretary.* Performs general office work and clerical duties. Takes and transcribes dictation, makes appointments for executives, answers and makes phone calls. Handles mail and writes routine correspondence.

16. *Chemist.* Performs analytical and research work in the general field of chemistry. Makes chemical tests on foods, drugs, dyes, paints, petroleum products, etc. Develops new processes.

17. *Optometrist.* Examines eyes and prescribes treatment to improve vision without use of medicine, drugs, or surgery. Refers patients with eye diseases to medical practitioner. Tests, prescribes, and fits lenses and glasses to correct visual deficiencies.

18. *Civil Engineer.* An engineer who plans, designs, and supervises the construction and maintenance of a large variety of structures or facilities such as roads, bridges, airports, power plants, water and sewage systems.

19. *Chemical Engineer.* An engineer who applies chemistry and various branches of the engineering sciences to the design, construction, and operation of equipment for carrying out chemical processes. Conducts research to develop new and improved chemical manufacturing processes.

20. *County Judge.* Presides as an arbitrator, advisor, and administrator of justice in a court of law. Deals with proving of wills and the administration of estates, checks accounts of estate executors, establishes rules of procedure for his court.

Set 4

1. *Mailman.* Delivers mail to private homes or businesses along an established route after sorting the mail according to streets and street numbers.

2. *Telephone Operator.* Operates telephone switchboard to relay incoming calls and make connection with outside lines by using a system of cords and switches to plug in correct circuit.

3. *Surveyor.* Supervises and directs work parties in determining locations and measurements of points, elevations, and contours of earth's surface. Calculates information needed to make maps, charts, land valuations and deeds. Verifies accuracy of survey data.

4. *Coal Miner.* Drives mine shafts, sets explosives, cleans debris, installs timbering and supports, shovels coal into mine cars. May operate machine to undercut coal and load into cars.

5. *Barber.* Cuts hair according to instructions of patron. Trims neckline using razor. Gives shampoos, scalp treatments, and shaves.

6. *Painter.* Paints sheds, houses, and other buildings. Mixes paint and matches colors. Erects scaffold.

7. *Cashier.* Receives and examines incoming cash, counts money, makes change, and prepares bank deposits. Prepares payroll and pay checks. Keeps record of cash transactions.

8. *Aeronautical Engineer.* An engineer who specializes in the design, construction, or testing of aircraft. Analyzes stresses to determine if aircraft will function properly under flight conditions. Supervises assembly of equipment and technical phases of air transportation.

9. *Architect.* Plans, designs, and oversees construction of buildings such as private residences, office buildings, factories, and similar structures. Furnishes professional advice on such matters as cost, design, materials, and equipment. Plans layout and prepares sketches of proposed buildings.

10. *Electrician Foreman.* Supervises a group of electricians. Interprets blueprints, sketches, or written orders. Determines work procedure. Assigns duties and inspects quantity and quality of work. Keeps time and production records.

11. *Librarian (Library Manager).* Manages a library. Supervises assistants and performs duties according to size of library. Selects books to be purchased. Supervises cataloging, classification, and circulation of books and periodicals.

12. *Airplane Navigator.* Locates position and directs course of airplane in flight through the use of navigational instruments and charts. Directs changes in course due to weather conditions. Keeps log of flight.

13. *Educational Psychologist.* Investigates processes of mental growth and development to guide individuals in the selection of academic or vocational courses leading to a suitable career. Analyzes causes of maladjustment of individuals in schools and recommends corrective action.

14. *Dentist.* A person engaged in any phase of dentistry such as extracting, cleaning, filling, or replacing teeth; performing corrective work such as straightening teeth; treating diseased tissues of the gum; performing surgical operations on jaw or mouth; and making and fitting false teeth.

15. *Bus Driver.* Transports passengers according to definite time schedule. Collects tickets or fares from passengers and keeps records of receipts. Assists passengers with baggage.

16. *Traffic Manager, Air Transportation.* Establishes freight and passenger rates in accordance with company policy. Consults and makes suggestions on problems related to traffic movement. Supervises operation of reservation and ticket offices.

17. *Baker.* Produces finished baked goods such as bread, cake, and pastries. Measures ingredients, mixes dough, bakes products in oven regulating timing and temperature.

18. *Plumber.* Assembles and installs air, gas, water, and waste-disposal systems. Tests joints and pipe system for leaks. Installs gas, water, and sanitary fixtures.

19. *Watch Repairman.* Cleans, adjusts, repairs, and oils watches and clocks. Checks for magnetism and demagnetizes watches when required. Performs jewelry repair.

20. *Aircraft Engine Mechanic.* Inspects and overhauls airplane engines. Examines engine operation for malfunction. Performs additional duties such as flushing crankcase and oiling moving parts.

Set 5

1. *Waiter.* Serves food to patrons. Sets tables with clean linen and silverware. Removes dirty dishes to kitchen and cleans equipment.

2. *Truck Driver, Heavy.* Drives a heavy truck to deliver or transport merchandise. Usually loads and unloads truck. May make minor repairs to vehicle.

3. *Laborer (Construction).* Erects, repairs, and wrecks buildings, bridges, and other types of construction. Digs ditches, mixes concrete, and uses various hand tools.

4. *Corporation Lawyer.* Advises corporation concerning its legal rights, and the advisability of prosecuting or defending a law suit. Acts as an agent of the corporation, and seeks to keep corporation from expensive law suits.

5. *Personnel Manager.* Formulates policies relating to the compensation, training, promotion, and welfare of employees. Supervises subordinates in carrying out these policies.

6. *Radio Operator.* Controls the operation and adjustment of all transmitters and receivers in a radio station. Makes minor repairs. Sends and receives radioteletype messages.

7. *Veterinarian.* Studies and treats diseases of animals. Advises on care and breeding of animals. Inspects animals intended for human consumption.

8. *Radio Repairman.* Tests and repairs defective radios. Test circuits and tubes using various testing meters and devices. Installs radios and antennas.

9. *Manager, Retail Automotive Service.* Manages a retail automobile service station which services autos with gas and oil. Supervises employees. Makes reports, takes inventory, and ensures premises are clean.

10. *Certified Public Accountent.* An accountant who has passed a state certification examination. Performs a variety of accounting services. Certifies financial statements, conducts financial investigations, and prepares or reviews tax returns.

11. *Messenger.* Sorts and delivers letters, messages, packages, documents, and records to various offices and sections within an establishment. Keeps records and receipts of articles delivered and received.

12. *Detective (Police).* Assists uniformed police in prevention of crime. Investigates known or suspected criminals. Examines scene of crime and questions individuals or witnesses concerned. Keeps records of such information and reports to superior officer. Arrests criminals when guilt has been established.

13. *Physicist.* Conducts research into phases of physical phenomena such as motion, gravity, laws of liquid pressure, heat, light, and electronics. May monitor scientific projects and serve as consultant.

14. *Professor, College or University.* A recognized authority in a particular field of knowledge. Conducts graduate and undergraduate classes in his field and oversees the research of others. Conducts research in his own area of interest.

15. *Personal Services Director.* Directs welfare activities for employees of industrial and commercial establishments. Arranges operation of libraries, recreational facilities, and educational courses. May assist employees in solution of personal problems.

16. *Floor Manager, Retail Store.* Supervises employees in a designated section of retail store. Instructs new workers, regulates hours, adjusts claims, and answers customer questions relative to merchandise.

17. *Carpenter.* Cuts, fits, and erects the wooden framework, partitions, subflooring, and other parts of a building. May install trim and finish work.

18. *Lineman.* Hangs telephone or telegraph wires on poles, cuts in feeder lines, and attaches appliances for telephone or telegraph communication.

19. *Calculator Operator.* Operates automatic calculating machine to check such records as inventories, financial accounts, pay rolls, invoices, and statistical reports.

20. *Garage Foreman.* Assigns duties to mechanics and inspects their work for quality and quantity. Keeps time, production, and other clerical records. May hire and discharge workers.

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13. ABSTRACT

This study investigated two approaches for obtaining job ratings in order to determine which procedure provided the most stable ratings, given a constant number of raters. Specifically, it compared reliability estimates determined by averaging across individually obtained job ratings and reliability estimates based on consensus ratings from interacting panels. To investigate reliability of job ratings obtained from individuals and from groups or panels of raters, 450 basic airman rated 100 brief job descriptions under three conditions; (*a*) individually, (*b*) in a 3-man panel, and (*c*) in a 5-man panel. Analyses revealed that estimates of mean reliability were larger for individually obtained ratings than for 3-man or 5-man panel ratings. There was also a trend for mean rating time to increase with an increase in panel size. Present findings tend to support the procedure of averaging across individual ratings, rather than the use of ratings from panels, in order to obtain more stable results. In terms of reliability, time required, and number of raters, the individual approach appears more economical and efficient than the board or panel procedure.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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